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# The "Sooper Snooper"

Listen in on conversations, bird calls, noisy engine bearings or even the sound of termites munching into your home.

By Ross Tester

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Here's the direct connection Snooper. Both it and the Parabolic mod use almost identical electronics - the main difference is th microphones and their mounting.

If all this sounds a bit hard to believe, we have to admit that we were a bit skeptical too. That is, until we tried out this amazing devi Or more correctly, two devices. That's because there are two versions of the Sooper Snooper, depending on what you want to do v it/them.

This particular Sooper Snooper is the one you would use to listen in to distant conversations, bird calls, etc – anything in the open which would normally be too far away or too faint to hear.

It has a microphone physically connected to a "probe" which is touched against the object you want to listen to – such things as bearings inside a hard disk drive (see, boss, I told you my hard disk was getting old!), vehicle engine noises (it's an old-timer mechanic's trick to hold a screwdriver on an engine block with the other end pushed against the ear – this one works on the same principle), you can even hear the water rushing through pipes – and much, much more.

[illegible]

Don't know which one would be more useful to you? Both have near-identical electronics, so you could build one and make the microphone "sensor" detachable so you could plug the other type in as required. That **would** be handy!

Best of all, the project is easy to build, low in cost and has a lot of "wow" factor. You'll amaze your family and friends – perhaps they'll be a little more careful when they're talking about you in future!!!

Oh yes, there's another feature we forgot to mention. This project can also act as an RF "sniffer" capable of detecting close-transmitting "bugs" or other radio frequency sources in the vicinity.

You could even use it to listen in to a neighbour's CB or amateur radio transmissions (of course, it won't get the other side of the conversation). If you attach it to an outside aerial, you'll probably find every local radio station coming in at once!

So the Sooper Snooper is one versatile little project.

The circuit is relatively straightforward, with an electret or dynamic microphone preamplifier (Q1) feeding into a "volume" pot (which you like, acts as a sensitivity control).

The output from the pot drives an LM386 amplifier IC which is capable of driving a speaker or pair of headphones.

You will note that there is a pair of Schottky diodes across the output for the headphones – these act as an automatic volume limiter stop your eardrums melting if someone yells into the microphone when you're least expecting it (Schottky diodes are used because their speed and low forward voltage).



Looking back to the input for a moment, there is an RF pickup (ie an antenna) which drives a voltage-doubling rectifier/detector – the output of which can be directed to the preamp via a link.



If you never plan to use the circuit as an RF sniffer, L1 and L2, D1 and D2, C1 and C2 and R12 could all be left out as they would have no function.

Two types of microphones can be used in this project.

In the parabolic model, a tiny electret insert is used to avoid "aperture blocking" of the dish. As you would no doubt know, electret microphones require a power source and in this circuit, power is derived from the 5.6V supply rail via a voltage divider and smoothing capacitor.

For the direct-pickup model, a dynamic microphone insert is used. As these require no power source, the feed resistor (4.7kΩ) is left out. The associated 1.5kΩ and 100μF capacitor have no function in this case and could be left out but it's probably just as easy to leave them in, just in case you want to use an electret mic later.

In the kit from Oatley Electronics, both types of microphone are supplied. The dynamic mic is a high quality Shure insert.

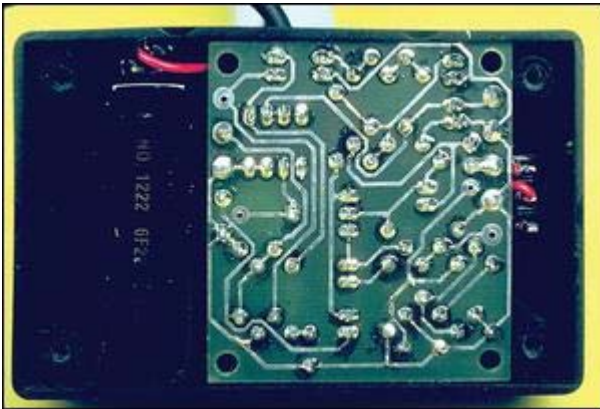
The 4.7kΩ resistor is also left out if you wish to use the circuit as an RF sniffer.

Construction

There are two parts to the construction – the electronics, which as we mentioned is basically common to both types of project, and t microphone pickups. We'll start with the electronics first.

With the obvious exception of the microphone and headphones, all components are mounted on a single PC board measuring 50 x mm. The dimensions of the board are actually quite critical because it must fit a particular way into a small jiffy box, measuring 83 x x 30 mm.

The board is not held in by screws; rather it sits upside-down on the ridges in the case, leaving enough room for the on/off swit underneath and the 9V battery alongside (the photos give an idea of the arrangement). Screwing the case lid on holds everythi captive.



And this is what the box looks like complete. The PC board is held i place on the integral mounting lugs on the side walls of the box. There's just enough room for the 9V battery. It's tight, but it all fits!

Start by assembling the PC board but first inspect it for any defects – bridges between or breaks in tracks, undrilled holes, etc. Th solder in the components, starting with the resistors (with the exception of the 4.7kΩ), then the capacitors, diodes, transistor and fina the IC.

If you need to, check the resistors with a digital multimeter and/or refer to the colour code table – just to make sure! And as alwa make sure that polarized components – diodes, electrolytic capacitors, transistors and ICs – are placed the right way around.

The trimpot can be soldered in last.

Now we turn our attention back to the 4.7kΩ resistor and the link: these depend on which version you are going to build.

If you want to build the parabolic Snooper with the electret mic, put the 4.7kΩ in. If you want to build the probe Snooper with t dynamic mic, leave the 4.7kΩ out. The link is soldered between points A and B for either "audio" Snooper or between points A and for the "RF" Snooper.

Finally, give the board a good checking over to make sure everything is right and in the right place.

Switch & socket option

Here's another idea: if you think you might like to build both versions, why not put a suitable socket on the case with matching plugs the two microphone types (a 3.5mm phono plug and socket would appear perfect). Then, mount a second switch inside the ca connected between the 4.7kW and point A. Switch the resistor "in" when you want to use the parabolic Snooper and "out" when y want to use the probe Snooper.

Resistor Colour Codes

No.	Value	4-Band Code (1%)	5-Band Code (1%)
1	39kΩ	orange white orange brown	orange white black red brown
2	10kΩ	brown black orange brown	brown black black red brown
1	4.7kΩ	yellow purple red brown	yellow purple black brown brown
1	3.9kΩ	orange white red brown	orange white black brown brown



1	1.5kΩ	brown green red brown	brown green black brown brown
1	1kΩ	brown black red brown	brown black black brown brown
1	680Ω	blue grey brown brown	blue grey black black brown
1	220Ω	red red brown brown	red red black black brown
2	22Ω	red red black brown	red red black gold brown
1	4.7Ω	yellow purple gold brown	yellow purple black silver brown

The headphones

The headphones are standard hifi (ie, low impedance) types. If you're using the Clarion ones from Oatley Electronics (as photograph with the kit), they attach to the PC board with the colour coding shown. Note that the wires in the cable are very fine and they also ne to have a tiny amount of insulation stripped from their ends.

Incidentally, these headphones are a real bargain at seventeen bucks a pair. They are very comfy and have an inbuilt level control ( the lead). Actually, this level control is the reason they're so cheap: it has a tiny manufacturing defect which you can very easily fix about thirty seconds with a screwdriver and a pair of pliers – a sheet which comes with the 'phones tells you how.

Once you've made the fix, you may decide they're too good for this kit and use them for your hifi system!

Of course, any other low impedance 'phones or earpieces should work perfectly if you happen to have some on hand. The colc coding of the cabling might be different, of course – you will have to determine which is which yourself. Then again, it doesn't rea matter if you get the left and right channels mixed up – this is a mono output!

Capacitor Codes		
Value	IEC Code	EIA Code
.015μF	153	15n
.0033μF	331	3n3
470pF	470	470p

The microphone(s)

As we mentioned before there are two types of microphones usable in this project, depending on whether you want to build t parabolic (ie, long range) model or the direct pick-up model.

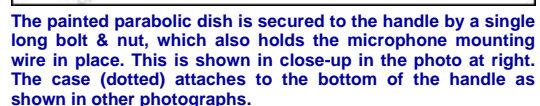
The Parabola



Before we describe how we made the parabolic Snooper, a word of warning. The parabolic dishes from Oatley are disposals typ which were intended for a small solar cooker. They do this by concentrating the sun's rays at the focal point – and it's easily t enough to set fire to paper/boil water/cook food/damage your eyes/cook you!

If you take the parabolic dish outside without having painted it a matte grey (as shown in our photos) BE CAREFUL. While your he will block most of the sun's rays, there could still be enough to do you serious mischief! So before you do anything, spray t aluminium para-bolic dish with matte grey paint.

OK, back to the Snooper electronics. Sound reflected back from the parabola is picked up by a tiny electret microphone insert (ie, t



When we say "somewhere near" we mean it: you don't have to be all that accurate for the unit to work very well indeed. Of course, theory suggests it will work best when the mic is mounted right at the focal point.

We mounted the microphone insert on a 150mm length of that highly specialized construction material we often use called "cotang wire". This won't be supplied in the kit but if you have any difficulty finding a piece, just look in your wardrobe...

We bent the wire into a "J" shape with the mic insert mounted at the bottom end of the "J". It's not actually secured to the wire; rather some heatshrink tubing holds it (and its fine shielded cable) onto the wire.

See the photo and you'll see the arrangement. (Heatshrink tubing is not supplied in the Oatley kit). Note that the electret mic polarised: it must be wired as shown or it won't reward you with any sound!



Looking at the Parabolic Sooper Snooper from the rear, showing how the dish is connected to the handle; the handle's connected to the case; the kneebone's connected to de thigh-bone . . .



The same photo taken straight-on: between the two pics you should get a pretty good idea of how it goes together!

At the top of the "J" we bent the wire over 90° with a pair of pliers then fashioned a little loop in it. The screw which holds the reflect to its handle also passes through this loop to hold the J-wire in position. Again, see the photographs.

The microphone on its J-wire can be moved around to find the best operating position but, as we mentioned, there is plenty of latitude for error. In fact, if you look at our photographs you may note that our mic is anything but on-axis. But it works very well!

We drilled a just-large-enough (about 2mm) hole through the parabola for the shielded microphone cable to pass. This then was secured to the handle and went from there into the electronics box.

If we were feeling real adventurous we might have drilled a small hole right through the length of the handle so that the cable was completely hidden. But we weren't! (And also we didn't have any really long drills available).



The completed "probe" which is actually a dynamic microphone insert Araldited to a long-bladed screwdriver.

Before moving onto the second type of Snooper, we should briefly describe that handle. It is simply a 35 x 18mm (dressed) softwood about 175mm long, cut as shown in our drawing. Both ends are cut at an angle; one end has a further cut to allow mounting of the parabola via a single long bolt and nut passing through an appropriately drilled hole.

Both handle and parabola were given a coat of grey spray paint before final assembly.

#### Direct pick-up model

This is considerably simpler than the previous type. All that is required is some form of pick-up which will transfer vibrations to the microphone without too much attenuation.

Our pick-up is actually a long, thin-bladed screwdriver with a hard plastic handle.

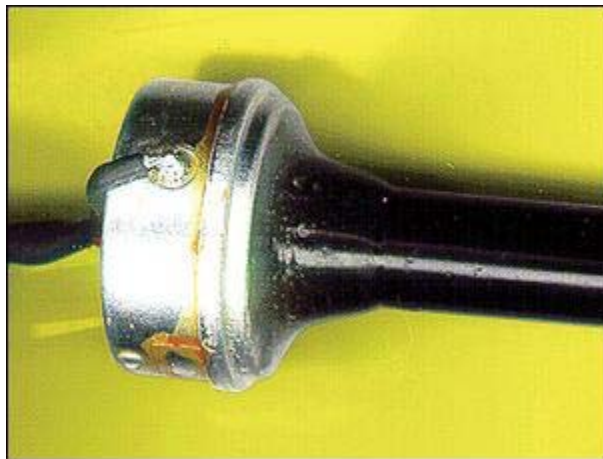
That part is important – a soft plastic would not transmit the sound vibrations as well as a hard plastic. The handle helps to stop the fingers absorbing or attenuating the sound vibrations picked up by the steel blade.

We filed the back of the handle truly flat, then simply glued the microphone insert to that flat with Araldite. Again, a hard glue ensures

maximum sound transfer.

We also filed off the screwdriver head to leave a flat "pickup". This is perhaps unnecessary but it also stops anyone trying to use this as a screwdriver!

Once the Araldite dried, we simply soldered the shielded mic lead to the appropriate points on the mic insert – and that basically finishes the second type of Snooper. Remember, though, that as this is a dynamic microphone that resistor we talked about before (4.7) should be left out.



Here's the back end of the probe showing how the screwdriver handle was ground flat then glued to the mic insert . . .



. . . and from the opposite side, with the connections to the shield cable which goes off to the preamp.

#### In use

If your soldering is up to scratch, you should be able to put the headphones on your head, turn the unit on – and listen. You might have to adjust VR1, the "volume" control (which in this case acts more like a sensitivity control) to get the level you want. But that's just all it.

If it doesn't work, once again check your soldering and component placement. Check that you have indeed included R4 if you made electret version (conversely, you left it out for the dynamic version).

Otherwise, measure a few voltages: the supply, of course and 5.6V across ZD1. Check that Q1 is operating by measuring the voltage between base and emitter – it should be about 0.6V. Finally, check that there is 9V between pins 6 and 4 of IC1.

If all these are OK, perhaps it's the 'phones that are giving you trouble. Unsolder them and briefly connect a 1.5V AA cell across the leads when you're not wearing them. A loud "click" means they're probably working fine.

Finally, with the 'phones back in place and VR1 set to maximum (ie, clockwise), do the "blurt" test: moisten your finger just a tad and apply it to the link connected to point "A". If you get a "blurt" from the headphones, you know the amplifier is OK – all it can be is a bad connection to the microphone insert. Did you forget the link from point A to point B?

#### Where do you get it?

This kit was designed by Oatley Electronics who hold the copyright on the design and the PC board.

Oatley Electronics have available the following kits and options:

**Electronics kit:** contains the PC board, all on-board components, battery snap and both electret and Shure dynamic mic inserts...\$22.00

**Box kit:** contains the jiffy box and on/off switch...\$5.00

**Parabola:** mill finish aluminium parabolic dish...\$25.00

**Headphones:** high quality Clarion PRO-97V stereo headphones (note - small manufacturing defect in volume control, easily fixed, repair instructions included)...\$17.00

**Screwdriver:** long screwdriver with solid plastic handle...\$1.00

**Not supplied:** 9V battery, cotanger wire, heatshrink, wood handle

**Contact:** Oatley Electronics, PO Box 89, Oatley NSW 2223 Phone (02) 9584 3563, Fax (02) 9584 3561  
email [sales@oatleyelectronics.com](mailto:sales@oatleyelectronics.com)  
[www.oatleyelectronics.com](http://www.oatleyelectronics.com)



**Parts List - Sooper Snooper**

1 9V battery  
1 9V battery snap  
1 SPST mini rocker switch  
1 PC board, 30 x 55mm  
1 case, 83 x 55 x 30mm (Altronics H-0105 or similar)  
1 pair hifi headphones

**Parabolic pickup:**

1 electret microphone insert  
1 Parabolic reflector, painted matte colour (grey)  
1 60cm length stiff wire (eg, coathanger)  
1 60mm M3 nut and bolt  
2 M3 washers  
1 wooden handle, approx 170mm long x 30mm wide x 18mm thick – see diagrams and text  
1 20mm length 12mm heatshrink tubing  
1 60mm length 3mm heatshrink tubing  
1 100mm length shielded cable (for microphone)  
Scraps of thin hookup wire (for switch connection, etc)

**Direct pickup:**

1 dynamic microphone insert  
1 steel rod, 2mm diameter, with hard plastic handle, length around 220mm  
1 2m length of shielded cable (for microphone)  
Araldite or similar glue.

**Semiconductors**

1 LM386 audio amplifier (IC1)  
1 BC549 NPN transistor (Q1)  
2 1N60 germanium diodes (D1, D2)  
2 1N5817 Schottky diodes (D3, D4)  
1 5.6V Zener diode (ZD1)

**Capacitors**

5 100 $\mu$ F 25VW PC mounting electrolytic  
2 1 $\mu$ F 25VW PC mounting electrolytic  
1 .015 $\mu$ F polyester or ceramic  
1 .0033 $\mu$ F polyester or ceramic  
1 470pF ceramic

**Resistors (0.25W, 1%)**

1 39kW  
2 10kW  
1 4.7kW  
1 3.9kW  
1 1.5kW  
1 1kW  
1 680W  
1 220W  
2 22W  
1 4.7W  
1 50kW preset pot, PC mounting



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